

# V-1 FACSIMILE ONLY

011 49 89 2399 4465  
Total Pages Faxed: 15

K. Coffey/A. Moline

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/EP

## PCT

## CHAPTER II

### DEMAND

under Article 31 of the Patent Cooperation Treaty:  
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only

Identification of IPEA

Date of receipt of DEMAND

#### Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference  
758.1509WOU1

International application No.  
PCT/US2004/018536

International filing date (day/month/year)  
10 June 2004  
(10.06.2004)

(Earliest) Priority date (day/month/year)  
12 June 2003  
(12.06.2003)

Title of invention

METHOD OF DISPENSING FUEL INTO TRANSIENT FLOW OF AN EXHAUST SYSTEM

#### Box No. II APPLICANT(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation.  
The address must include postal code and name of country.)

DONALDSON COMPANY, INC.  
1400 West 94th Street  
P.O. Box 1299  
Minneapolis, Minnesota 55440-1299  
United States of America

Telephone No.:

Facsimile No.:

Teleprinter No.:

Applicant's Registration No. with the Office:

State (that is, country) of nationality:  
US

State (that is, country) of residence:  
US

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

HOU, Zhixin (Jason)  
2572 Oakridge Court  
Maplewood, Minnesota 55119  
United States of America  
(Applicant for US designation only)

State (that is, country) of nationality:  
CN

State (that is, country) of residence:  
US

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

WAGNER, Wayne M.  
120 Redwood Drive  
Apple Valley, Minnesota 55124  
United States of America  
(Applicant for US designation only)

State (that is, country) of nationality:  
US

State (that is, country) of residence:  
US



Further applicants are indicated on a continuation sheet.

## Continuation of Box No. II APPLICANT(S)

*If none of the following sub-boxes is used, this sheet is not to be included in the demand*

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

ZHANG, Wenzhong  
13542 Foxberry Road  
Savage, Minnesota 55328  
United States of America

*(Applicant for US designation only)*

State *(that is, country)* of nationality:

CN

State *(that is, country)* of residence:

US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

STEINBRUECK, Edward A.  
16671 N. Hillcrest Court  
Eden Prairie, Minnesota 55346  
United States of America

*(Applicant for US designation only)*

State *(that is, country)* of nationality:

US

State *(that is, country)* of residence:

US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

ANGELO, Theodore G.  
838 Idaho Avenue West  
St. Paul, Minnesota 55117  
United States of America

*(Applicant for US designation only)*

State *(that is, country)* of nationality:

US

State *(that is, country)* of residence:

US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

WIEGANDT, Ted J.  
4126 Oakbrooke Curve  
Eagan, Minnesota 55112  
United States of America

*(Applicant for US designation only)*

State *(that is, country)* of nationality:

US

State *(that is, country)* of residence:

US



Further applicants are indicated on another continuation sheet.

## Continuation of Box No. II APPLICANT(S)

*If none of the following sub-boxes is used, this sheet is not to be included in the demand*

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

ANDERSON, Mike  
2817 106th Street West  
Bloomington, Minnesota 55431  
United States of America

*(Applicant for US designation only)*

State *(that is, country)* of nationality:

US

State *(that is, country)* of residence:

US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

☐

Further applicants are indicated on another continuation sheet.

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is ☒ agent ☐ common representative

and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BRUESS, Steven C.  
Merchant & Gould P.C.  
P.O. Box 2903  
Minneapolis, Minnesota 55402-0903  
United States of America

Telephone No.:  
612/ 336-4711

Facsimile No.:  
(612) 336-4751

Teleprinter No.:

Agent's registration No. with the Office:  
34,130

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:\***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as filed  
the description ☐ as originally filed  
☐ as amended under Article 34

the claims ☐ as originally filed  
☐ as amended under Article 19 (together with any accompanying statement)  
☒ as amended under Article 34

the drawings ☐ as originally filed  
☐ as amended under Article 34

2 ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed

3 ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of the applicable time limit under Rule 69.1(d).

4 ☐ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

\* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

**Language for the purposes of international preliminary examination: English**

☒ which is the language in which the international application is filed.  
☐ which is the language of a translation furnished for the purposes of international search.  
☐ which is the language of publication of the international application.  
☐ which is the language of the translation (to be) furnished for the purposes of the international preliminary examination.

**Box No. V ELECTION OF STATES**

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

**Box No. VI CHECK LIST**

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- |    |   |   |   |        |
|----|---|---|---|--------|
| 1. | translation of international application                              | : | 0 | sheets |
| 2. | amendments under Article 34   | : | 4 | sheets |
| 3. | copy (or, where required, translation) of amendments under Article 19 | : | 3 | sheets |
| 4. | copy (or, where required, translation) of statements under Article 19 | : | 1 | sheets |
| 5. | letter  | : | 1 | sheets |
| 6. | other ( <i>specify</i> ):   | : | 0 | sheets |

For International Preliminary  
Examining Authority use only

received                      not received

<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- |    |                                     |                                     |    |                          |  |
|----|-------------------------------------|-------------------------------------|----|--------------------------|--|
| 1. | <input checked="" type="checkbox"/> | fee calculation sheet               | 5. | <input type="checkbox"/> | statement explaining lack of signature                         |
| 2. | <input type="checkbox"/>            | original separate power of attorney | 6. | <input type="checkbox"/> | sequence listing in computer readable form                     |
| 3. | <input type="checkbox"/>            | original general power of attorney  | 7. | <input type="checkbox"/> | tables in computer readable form related to a sequence listing |
| 4. | <input type="checkbox"/>            | copy of general power of attorney   | 8. | <input type="checkbox"/> | other ( <i>specify</i> ):                                      |

**Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

By

  
Bruess, Steven C.

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

6. ☐ The date of the receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, do not apply.

7. ☐ The date of the receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5.

8. ☐ Although the date of the receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

## FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">International application No. PCT/US2004/018536</div> <div style="border: 1px solid black; padding: 5px;">Applicant's or agent's file reference 758.1509WOU1</div>	<div style="border: 1px solid black; padding: 5px; text-align: center;">For International Preliminary Examining Authority use only</div> <div style="border: 1px solid black; height: 100px; margin-top: 10px;"></div>																				
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Applicant DONALDSON COMPANY, INC.</div>																					
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"><b>Calculation of prescribed fees</b></div> <table style="width: 100%; border-collapse: collapse;"><tr><td style="width: 30%;">1. Preliminary examination fee</td><td style="width: 10%; text-align: center;">EUR</td><td style="width: 20%; border: 1px solid black; text-align: center;">1530</td><td style="width: 10%; border: 1px solid black; text-align: center;">P</td><td style="width: 30%;"></td></tr><tr><td>2. Handling fee (<i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i>)</td><td style="text-align: center;">EUR</td><td style="border: 1px solid black; text-align: center;">129</td><td style="border: 1px solid black; text-align: center;">H</td><td></td></tr><tr><td>3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box</td><td style="text-align: center;">EUR</td><td colspan="3" style="border: 1px solid black; text-align: center; padding: 5px;">1659</td></tr><tr><td></td><td></td><td colspan="3" style="border: 1px solid black; text-align: center; padding: 5px;">TOTAL</td></tr></table>		1. Preliminary examination fee	EUR	1530	P		2. Handling fee ( <i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i> )	EUR	129	H		3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	EUR	1659					TOTAL		
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2. Handling fee ( <i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i> )	EUR	129	H																		
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<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"><b>Mode of Payment</b></div> <table style="width: 100%; border-collapse: collapse;"><tr><td style="width: 30%;"><input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)</td><td style="width: 30%;"><input type="checkbox"/> cash</td></tr><tr><td><input type="checkbox"/> Cheque</td><td><input type="checkbox"/> revenue stamps</td></tr><tr><td><input type="checkbox"/> postal money order</td><td><input type="checkbox"/> coupons</td></tr><tr><td><input type="checkbox"/> bank draft</td><td><input type="checkbox"/> other (<i>specify</i>):</td></tr></table>		<input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash	<input type="checkbox"/> Cheque	<input type="checkbox"/> revenue stamps	<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons	<input type="checkbox"/> bank draft	<input type="checkbox"/> other ( <i>specify</i> ):												
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<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"><b>Deposit Account Authorization</b> (<i>this mode of payment may not be available at all IPEAs</i>)</div> <table style="width: 100%; border-collapse: collapse;"><tr><td style="width: 30%;"><input checked="" type="checkbox"/> authorization to charge the total fees indicated above.</td><td style="width: 70%;"></td></tr><tr><td><input checked="" type="checkbox"/> (<i>this check-box may be marked only if the conditions for deposit accounts of the IPEA so permits</i>) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.</td><td></td></tr></table>		<input checked="" type="checkbox"/> authorization to charge the total fees indicated above.		<input checked="" type="checkbox"/> ( <i>this check-box may be marked only if the conditions for deposit accounts of the IPEA so permits</i> ) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.																	
<input checked="" type="checkbox"/> authorization to charge the total fees indicated above.																					
<input checked="" type="checkbox"/> ( <i>this check-box may be marked only if the conditions for deposit accounts of the IPEA so permits</i> ) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.																					
<div style="display: flex; justify-content: space-between;"><div>IPEA/EP Deposit Account No.: 2830 0082 Date: 22 April 2005 Name: BRUESS, Steven C.</div><div>Signature: </div></div>																					

IAP20 Rec'd PCT/PTO 12 DEC 2005

In re application of : DONALDSON COMPANY, INC. et al.  
Application Serial No. : PCT/US2004/018536  
Filed : 10 June 2004 (10.06.2004)  
Agent Ref. : 758.1509WOU1  
Title : METHOD OF DISPENSING FUEL INTO TRANSIENT  
FLOW OF AN EXHAUST SYSTEM

**PRELIMINARY AMENDMENT UNDER ARTICLE 34**

European Patent Office  
D-80298 Munchen 2  
GERMANY

Sir:

Prior to Examination, Applicant requests the following amendments be made to the above-identified patent application.

**IN THE CLAIMS**

Please amend the claims by substituting previous claim pages 18 through 20 with new claim pages 18 through 21. The claims correspond to the previous claims (as amendments submitted 22 March 2005 in response to the search report:

<u>Previous Claims</u>		<u>New Claims</u>
1-16	=	1-16 (unchanged)
	=	17-26 (new)

**REMARKS**

These changes are being made to further clarify the claimed invention.

Respectfully submitted,

MERCHANT & GOULD P.C.  
P.O. Box 2903  
Minneapolis, Minnesota 55402-0903  
United States of America  
612.336.4711

Dated: April 22, 2005

By Steven C. Bruess  
Steven C. Bruess  
USPTO Reg. No. 34,130

We claim:

1. A method for injecting fuel into a transient exhaust stream of an exhaust system, the method comprising:
  - selecting a control volume within the exhaust system; and
  - using a model derived from a transient energy balance equation for the control volume to determining the rate for fuel to be dispensed into the exhaust stream.
2. The method of claim 1, wherein the control volume includes a catalytic converter, wherein the catalytic converter is positioned upstream from a diesel particulate filter, wherein the fuel is dispensed upstream of the catalytic converter, and wherein rate for dispensing the fuel is selected to achieve a temperature at a downstream end of the catalytic converter that is suitable for causing regeneration of the diesel particulate filter without causing the diesel particulate filter to overheat.
3. The method of claim 1, wherein the exhaust system includes a catalytic converter positioned upstream from a diesel particulate filter and a fuel dispensing nozzle positioned upstream from the catalytic converter, and wherein the control volume starts upstream from the fuel dispensing nozzle and ends at the downstream end of the catalytic converter.
4. The method of claim 1, further comprising accessing pressure, temperature and mass flow data for the exhaust system, and using the data in concert with the model to determine the rate of fuel to be injected.
5. The method of claim 1, wherein the exhaust system includes a catalytic converter positioned upstream from a diesel particulate filter and a fuel injector positioned upstream from the catalytic converter, wherein temperature and pressure data are sensed upstream of the fuel injector and downstream of the catalytic converter, and wherein the temperature and pressure data are used in concert with the model to determine a fuel injection rate suitable to reach a temperature at the downstream end of the catalytic converter that is within a target temperature range.

6. The method of claim 2, wherein the model takes into consideration the vaporization efficiency of the fuel.
7. The method of claim 2, wherein the model takes into consideration the fuel conversion efficiency of the catalytic converter.
8. The method of claim 2, wherein the model takes into consideration the thermal energy storage rate of the catalytic converter.
9. The method of claim 2, wherein the model takes into consideration mass flow through the control volume.
10. An exhaust system comprising:
  - an exhaust conduit;
  - a fuel injection nozzle for injecting fuel into the exhaust conduit;
  - an air line for supplying air to the nozzle;
  - a fuel line for supplying fuel to the nozzle; and
  - a controller for determining a rate of fuel to be injected into the exhaust conduit.
11. The exhaust system of claim 10, further comprising a pre-mix region in which the air and fuel are mixed prior to reaching the nozzle.
12. The exhaust system of claim 10, wherein the air and fuel are mixed at the nozzle.
13. The exhaust system of claim 1, further comprising a catalytic converter and a diesel particulate filter positioned within the exhaust conduit, the catalytic converter being positioned upstream of the diesel particulate filter and the nozzle being positioned upstream from the catalytic converter.
14. The exhaust system of claim 13, wherein the controller controls a rate of fuel injected into the exhaust conduit by the fuel injection nozzle to reach a temperature at the diesel particulate filter suitable for causing regeneration.

15. The exhaust system of claim 10, wherein the nozzle is positioned upstream from a lean NOx catalyst.
16. The exhaust system of claim 10, wherein the nozzle is positioned upstream from a NOx absorber.
17. The exhaust system of claim 10, wherein the pressure of the fuel supplied to the fuel injection nozzle is 40 to 100 pounds per square inch.
18. The exhaust system of claim 10, wherein the pressure of the fuel supplied to the fuel injection nozzle is 70 pounds per square inch.
19. The exhaust system of claim 10, wherein the pressure of the air supplied to the fuel injection nozzle is 10 to 50 pounds per square inch.
20. The exhaust system of claim 10, wherein the pressure of the air supplied to the fuel injection nozzle is 30 pounds per square inch.
21. The exhaust system of claim 10, wherein the pressure of the fuel supplied to the fuel injection nozzle is 30 to 50 pounds per square inch greater than the pressure of the air supplied to the fuel injection nozzle.
22. The exhaust system of claim 10, further comprising a fuel pump for supplying pressurized fuel to the fuel line and a fuel pressure regulator for regulating the pressure of the fuel within the fuel line.
23. The exhaust system of claim 10, further comprising an air tank in fluid communication with the air line.
24. The exhaust system of claim 10, further comprising an air pressure regulator in fluid communication with the air line for regulating the pressure of the air within the air line.

25. The exhaust system of claim 10, further comprising a solenoid valve in fluid communication with the air line for controlling the flow of air within the air line.

26. The exhaust system of claim 10, further comprising:

a solenoid valve in fluid communication with the air line for controlling the flow of air within the air line;

an air pressure regulator in fluid communication with the air line for regulating the pressure of the air within the air line

a fuel pump for supplying pressurized fuel to the fuel line;

a fuel pressure regulator for regulating the pressure of the fuel within the fuel line;

wherein the solenoid valve, the air pressure regulator, the fuel pump, the fuel pressure regulator, and the fuel injection nozzle are packaged within a single housing having fuel line connections, air line connections, and electrical connections.

**VIA FACSIMILE ONLY**

**011 41 22 740 14 35**

**Total Pages Faxed: 4**

K. Coffey A. Moline

In re application of : DONALDSON COMPANY, INC. et al.  
Application Serial No. : PCT/US2004/018536  
Filed : 10 June 2004 (10.06.2004)  
Agent Ref. : 758.1509WOU1  
Title : METHOD OF DISPENSING FUEL INTO TRANSIENT  
FLOW OF AN EXHAUST SYSTEM  
Due Date : 24 March 2005 (24.03.2005)

**PRELIMINARY AMENDMENT UNDER ARTICLE 19(1)**

WIPO  
34, chemin des Colombettes  
1211 Geneva 20  
Switzerland

Sir:

It is requested that the claims of the above-referenced application be amended in response to the International Search Report. Replacement claim pages 18 through 20 are attached to replace original claim pages 18 through 21. The claims correspond to the original PCT claims as follows:

<u>Original Claims</u>		<u>New Claims</u>
1-9	=	1-9 (unchanged)
10-21	=	Canceled
22-28	=	10-16 (renumbered)

**REMARKS**

These changes are being made to further clarify the claimed invention.

Respectfully submitted,

MERCHANT & GOULD P.C.  
P.O. Box 2903  
Minneapolis, Minnesota 55402-0903  
United States of America  
612.336.4617

Dated: 3/22/15

By 

David G. Schmaltz  
Reg. No. 39,828

We claim:

1. A method for injecting fuel into a transient exhaust stream of an exhaust system, the method comprising:
  - selecting a control volume within the exhaust system; and
  - using a model derived from a transient energy balance equation for the control volume to determining the rate for fuel to be dispensed into the exhaust stream.
2. The method of claim 1, wherein the control volume includes a catalytic converter, wherein the catalytic converter is positioned upstream from a diesel particulate filter, wherein the fuel is dispensed upstream of the catalytic converter, and wherein rate for dispensing the fuel is selected to achieve a temperature at a downstream end of the catalytic converter that is suitable for causing regeneration of the diesel particulate filter without causing the diesel particulate filter to overheat.
3. The method of claim 1, wherein the exhaust system includes a catalytic converter positioned upstream from a diesel particulate filter and a fuel dispensing nozzle positioned upstream from the catalytic converter, and wherein the control volume starts upstream from the fuel dispensing nozzle and ends at the downstream end of the catalytic converter.
4. The method of claim 1, further comprising accessing pressure, temperature and mass flow data for the exhaust system, and using the data in concert with the model to determine the rate of fuel to be injected.
5. The method of claim 1, wherein the exhaust system includes a catalytic converter positioned upstream from a diesel particulate filter and a fuel injector positioned upstream from the catalytic converter, wherein temperature and pressure data are sensed upstream of the fuel injector and downstream of the catalytic converter, and wherein the temperature and pressure data are used in concert with the model to determine a fuel injection rate suitable to reach a temperature at the downstream end of the catalytic converter that is within a target temperature range.

6. The method of claim 2, wherein the model takes into consideration the vaporization efficiency of the fuel.
7. The method of claim 2, wherein the model takes into consideration the fuel conversion efficiency of the catalytic converter.
8. The method of claim 2, wherein the model takes into consideration the thermal energy storage rate of the catalytic converter.
9. The method of claim 2, wherein the model takes into consideration mass flow through the control volume.
10. An exhaust system comprising:
  - an exhaust conduit;
  - a fuel injection nozzle for injecting fuel into the exhaust conduit;
  - an air line for supplying air to the nozzle;
  - a fuel line for supplying fuel to the nozzle; and
  - a controller for determining a rate of fuel to be injected into the exhaust conduit.
11. The exhaust system of claim 10, further comprising a pre-mix region in which the air and fuel are mixed prior to reaching the nozzle.
12. The exhaust system of claim 10, wherein the air and fuel are mixed at the nozzle.
13. The exhaust system of claim 1, further comprising a catalytic converter and a diesel particulate filter positioned within the exhaust conduit, the catalytic converter being positioned upstream of the diesel particulate filter and the nozzle being positioned upstream from the catalytic converter.
14. The exhaust system of claim 13, wherein the controller controls a rate of fuel injected into the exhaust conduit by the fuel injection nozzle to reach a temperature at the diesel particulate filter suitable for causing regeneration.

15. The exhaust system of claim 10, wherein the nozzle is positioned upstream from a lean NOx catalyst.

16. The exhaust system of claim 10, wherein the nozzle is positioned upstream from a NOx absorber.